APPENDIX B

WASTE PROCESSING ALTERNATIVE SELECTION PROCESS

NOTE: This appendix and the references associated with it refer to the historically used radioactive waste terms, sodium bearing waste (SBW) and newly generated liquid waste. These terms have been used at the INEEL over the years to describe liquid radioactive wastes generated in association with high level waste and other waste management activities.

In July 1999, the Department of Energy published DOE Order 435.1 "Radioactive Waste Management." This Order establishes terms and definitions for radioactive waste. The radioactive waste terms used in the main body of this Idaho HLW & FD EIS refer to the terms specified in the Order. In most cases, this EIS parenthetically refers to the historical waste term.

To assist the reader in corresponding the historical radioactive waste terms used in this appendix with radioactive waste terms used in the main body of this EIS and the Summary, a cross-reference table has been provided in Section 1.2.2 of Volume 1 of this EIS.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

List of Tables

APPENDIX B. WASTE PROCESSING ALTERNATIVE SELECTION PROCESS

B.1 Introduction

The U.S. Department of Energy (DOE) is preparing the Idaho High-Level Waste and Facilities Disposition Environmental Impact Statement (Idaho HLW & FD EIS), in accordance with the National Environmental Policy Act, to support the HLW decision-making process at the Idaho National Engineering and Environmental Laboratory (INEEL) formerly called the Idaho National Engineering Laboratory or INEL. Under the National Environmental Policy Act in 40 CFR 1502.14(a), an EIS must "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

The Notice of Intent for the Idaho HLW & FD EIS (62 FR 49209; September 19, 1997) identified three initial alternatives for managing the HLW at INEEL: the Proposed Action or Separations Alternative, No Action Alternative, and Non-Separations Alternative. Since the issuance of the Notice of Intent and in the course of exploring and evaluating reasonable alternatives for detailed EIS study, DOE has added a number of sub-alternatives, or options, that are variations of the three initial alternatives, and DOE has added two alternatives.

This appendix is a summary of the information contained in the document *Process for Identifying Potential Alternatives for the INEEL High-Level Waste and Facilities Disposition Draft Environmental Impact Statement* (DOE 1999). Appendix F of DOE (1999) represents DOE's alternative refinement process described in Section B.6.

B.2 Purpose

The purpose of this appendix is to describe the selection process that DOE employed to identify a reasonable range of waste processing alternatives for the Idaho HLW & FD EIS, including the identification and application of the criteria for assessing the validity of candidate alternatives. For purposes of this appendix, as well as this EIS, an "alternative" is defined as a complete set of proposed DOE actions to manage the INEEL HLW and other related wastes from the current state to an acceptable

end state that, with the exception of the No Action Alternative and the Continued Current Operations Alternative, meets the HLW program purpose and need as stated in the Idaho HLW Notice of Intent.

The Council on Environmental Quality regulations direct all Federal agencies to use the National Environmental Policy Act process to identify and assess the reasonable alternatives to proposed actions that would avoid or minimize adverse effects of these actions upon the quality of the human environment [40 CFR 1500.2(e)]. These regulations further state that "reasonable alternatives include those that are practical or feasible from a common sense, technical, or economic standpoint. The number of reasonable alternatives considered in detail should represent the full spectrum of alternatives meeting the agency's purpose and need; but an EIS need not discuss every unique alternative, when an unmanageable number is involved."

The primary steps of this alternative selection process are:

- Review previous HLW management studies, DOE EISs, technical literature, industry recommendations, and stakeholder comments
- Identify an initial list of candidate alternatives
- Review engineering studies and public input
- Revise initial set of candidate alternatives based on recent studies and stakeholder inputs following the Notice of Intent and scoping meetings
- Identify screening criteria to evaluate the candidate alternatives
- Describe criteria that were used to assess each alternative
- Apply the screening criteria to each candidate alternative
- Select the recommended set of candidate alternatives for the Idaho HLW & FD EIS

B.3 Identification of Candidate Alternatives

B.3.1 ANALYSIS OF PREVIOUS INEEL AND OTHER HLW DOE STUDIES

The following paragraphs summarize the pre-1992 HLW activities and studies and the post-1992 HLW management studies. The 1992 date is significant because that is when DOE decided to discontinue the processing of spent nuclear fuel (DOE 1992). Details of these HLW activities and studies are contained in Section 4.0 of DOE (1999).

B.3.1.1 Pre-1992 Activities and Studies

"Historical Fuel Reprocessing and HLW Management in Idaho" (Knecht et al. 1997)

A summary of historical fuel reprocessing and waste management at the Idaho Nuclear Technology and Engineering Center (INTEC) (formerly called the Idaho Chemical Processing Plant or ICPP) appeared in Radwaste Magazine (Knecht et al. 1997). The article outlines some of the early technology development work at INTEC and includes 40 references related to waste forms produced from calcine, such as metal spray coating, grout matrix, metal matrix, glass, and ceramic. Early studies were also carried out in calcine retrieval, calcine dissolution, calcine stabilization, and transuranic element separation. In many cases, results of early technology development work were used to develop pre-conceptual design and costs. The design information supported the INEEL portion of a number of complex-wide defense waste management studies under the Atomic Energy Commission and the Energy Research and Development Agency, predecessors to DOE.

***Alternatives for Long-Term Management of Defense High-Level Waste, Idaho Chemical Processing Plant*, ERDA 77-43 (ERDA 1977)**

This INTEC report evaluated and provided cost and risk estimates for three alternatives: (1) retain the waste at INTEC in retrievable storage facilities; (2) ship the waste to a geologic repository; and (3) remove (separate) the actinides, ship the actinides to a geologic repository, and store the remaining waste at INTEC. Waste form options under these alternatives included calcine pelletization, metal matrix, and sintered glass ceramic to span the range of calcine, concrete, metal, glass and ceramic waste forms.

Environmental Evaluation of Alternatives for Long-Term Management of Defense High-Level Radioactive Waste at the ICPP, IDO-10105 **(DOE 1982a)**

The subject evaluation considered four alternatives: (1) calcine all waste and leave calcine in place (no action); (2) retrieve, modify the calcine, and dispose of modified calcine at INEEL; (3) retrieve, separate the actinides, dispose of the actinides offsite, and dispose of the remaining waste at INEEL; (4) delay retrieval, modify the calcine, and dispose of the calcine offsite. In this study the waste form options included calcine, glass or pelletized calcine, glass or stabilized calcine, glass for actinides, and calcine for onsite disposal.

Long-Term Management of Defense High-Level Radioactive Wastes [Research and Development Program for Immobilization], Savannah River Plant, **DOE/EIS-0023 (DOE 1979)**

From 1970 to 1983 events outside of INEEL, such as waste-form research at DOE's Savannah River Site (SRS) influenced the INEEL HLW research and development program. As a result, DOE HLW management became focused on treating wastes first at SRS, then Hanford Site, and finally Idaho. In 1977, DOE issued this EIS for HLW immobilization research and development. This EIS evaluated a number of potential HLW forms, and a follow-on environmental assessment selected borosilicate glass as the preferred form (DOE 1982b).

The Defense Waste Management Plan, **DOE/DP-0015 (DOE 1983)**

This plan established a schedule for waste treatment and assumed that the Savannah River Site and Hanford Site would vitrify their HLW. INEEL was assumed to construct a new facility to immobilize newly generated liquid waste as well as calcined HLW with annual production of approximately 500 HLW canisters. This plan provided estimates of HLW volumes to be generated through 2015. Subsequently, DOE-Idaho Operations Office completed the study (DOE 1983) in 1983 to evaluate reducing waste volumes by more efficient fuel processing methods.

B.3.1.2 Post-1992 HLW Management Studies

***ICPP Tank Farm System Analysis* (WINCO-1192) (WINCO 1994)**

This Tank Farm study proposed 14 variations of HLW separations alternatives. These alternatives differ with respect to the start of separations and immobilization operations, the number of calcining campaigns required, and various calcine pretreatment and treatment technologies. The conclusion was that the separation variations produced significant differences in calcine processing rates, bin set storage requirements, and final waste forms. This study underscored the advantages of a separations alternative and brought out the possibility of HLW calcine vitrification as a viable non-separations option.

***SBW Treatment Study,* WBP-8-95/ALO-3-95 (LITCO 1995a)**

The study evaluated feasible options for meeting the Notice of Noncompliance Consent Order to cease use of the INTEC pillar and panel tanks and the remaining tanks in the Tank Farm. The study addressed 15 separations and non-separations alternatives. The separations alternatives used an evaporation precipitation technique to reduce the sodium content of the SBW prior to calcining; the separations options also included cesium, strontium, and transuranic extraction methods for separating the high-activity fraction from the low-activity fraction. The non-separations alternatives focused on improving the calcine process by high-temperature operation or using additives such as aluminum nitrate, silica, and sugar to reduce the SBW volume. The study also included an alternative to ship all the concentrated SBW to Hanford for interim storage and processing.

***ICPP Radioactive Liquid and Calcine Waste Technologies Evaluation Technical Report and Recommendation,* INEL-94/0019 (LITCO 1995b)**

The purpose of the evaluation was to support DOE in developing a strategic plan to manage INTEC radioactive liquid and calcined waste by presenting performance data for viable candidate alternatives. The study addressed 27 alternatives for waste treatment including both separations and non-separations techniques. These alternatives varied with respect to facilities, SBW treatment, calciner operations, and calcine treatment. Screening against six criteria led to radionuclide partitioning as one of the top options to be considered. The report recommended a two-phased implementation of a high-activity waste immobilization plant to spread the funding requirements over a longer time period.

***HLW Alternatives Evaluation,* WBP-29-96 (LMITCO 1996)**

This study reviewed calcination and separations to determine the best path forward for INTEC HLW management. Both approaches appear to be reasonable, meet the Settlement Agreement/Consent Order and are technically feasible; the primary discriminator is cost. These approaches were developed into three basic options: (1) calcination of HLW until June 1998 and SBW until 2012; (2) calciner shutdown in 2001, radionuclide separation/grouting beginning in 2010, and calcine retrieval, dissolution, and separation commencing in 2015; and (3) separations and shipping of the high-activity waste offsite for immobilization and storage.

***Regulatory Analysis and Proposed Path Forward for the Idaho National Engineering Laboratory High-Level Waste Program,* DOE/ID-10544 (DOE 1996)**

This report provided a concise HLW regulatory analysis of the radionuclide constituents, identification of Resource Conservation and Recovery Act (RCRA) hazardous constituents, and plans for closure of the INTEC Tank Farm and bin sets. The report offered four major alternatives for consideration: no action, planning basis (DOE 1998), full treatment (separations), and limited vitrification.

B.3.2 CONSIDERATION OF PUBLIC COMMENTS

DOE conducted public scoping workshops on the Idaho HLW & FD EIS on October 16, 1997 in Idaho Falls, Idaho and on October 23, 1997 in Boise, Idaho. These public workshops and written scoping comments provided DOE public input about issues and potential alternatives that should be addressed in the Idaho HLW & FD EIS.

DOE also received scoping comments from the State of Idaho INEEL Oversight Program (Trever 1997), the State of Nevada Nuclear Waste Project Office (Loux 1997), and the INEEL Citizens Advisory Board (Rice 1997). All public comments were considered in developing the candidate alternatives for the Idaho HLW & FD EIS. A summary of the major stakeholder concerns appears in the next section; a list of new or modified alternatives obtained from the public inputs is shown later in the chapter.

B.3.2.1 Overall Stakeholder Concerns

Treatment Criteria – At this time, there is considerable uncertainty regarding the proposed repository at Yucca Mountain and the final technical standards for wastes to be disposed of there. Given those uncertainties, determine what criteria DOE should use to establish that the waste form(s) produced are suitable for disposal in a geologic repository outside the State of Idaho (i.e., that a "road-ready" waste form has been achieved).

Disposal – If a geologic repository is not available, determine what other disposal options exist for HLW outside the State of Idaho.

Storage/Disposal in Idaho – Clearly examine and explain any proposal to store or dispose of treated waste over the Snake River Plain aquifer, including performance-based or landfill closure of the Tank Farm as opposed to clean closure.

Hazardous Constituents – Develop a strategy for dealing with RCRA-regulated hazardous constituents.

Technical Viability/Privatization – Demonstrate in advance that the alternative selected will work. Stakeholders were cautious regarding privatization of the proposed actions.

Cost-risk benefits – The alternative selected should reduce health and safety risks enough to justify the cost of treatment and any additional risk to workers posed by the treatment activities.

Funding – Cleanup of the INEEL site is important, and the Federal government should seek adequate funding to honor its commitments to do so.

Compliance Concerns – Numerous, and in some cases conflicting, compliance requirements exist for INEEL HLW management and facilities disposition activities. These conflicts should be clarified, and the compliance factors prioritized. The majority of the stakeholders are supportive of the Settlement Agreement/Consent Order. Some stakeholders advocate consideration of "a fully compliant" alternative.

B.3.2.2 Public Comments Applied to Alternative Development

The following list of comments relate to new or modified alternatives resulting from stakeholder inputs. DOE considered these comments when preparing the list of Idaho HLW & FD EIS candidate alternatives.

- Include a true no action alternative—lock up and walk away.
- Postpone any action until waste decays to non-harmful levels, better technologies are developed, or disposal sites are identified.
- Calcine now, store onsite, and treat later when DOE disposal sites are available.
- Fully review options for disposing INEEL HLW onsite in Idaho.
- Dispose of high-activity and low-activity waste offsite, such as in a new repository.
- Store both high-activity and low-activity waste onsite for long-term time periods.
- Separate the transuranics out of HLW, dispose of at the Waste Isolation Pilot Plant, and dispose of the remainder at INEEL.
- Identify alternatives for bin set and Tank Farm closure including clean closure of HLW tanks.
- Consider a wide range of separations technologies.
- Vitrify all HLW before or after calcination.
- Consider technologies from other sites and countries.
- Ship HLW for treatment and long-term storage elsewhere such as the Nevada Test Site in Nevada.
- Explore volume reduction, filtration, and encapsulation technologies.
- Modify the No Action Alternative to include placement of calcine in closed INTEC tanks.

- Analyze treatment and disposal alternatives separately.

- Develop alternatives for facility disposition.

- Analyze all waste in all bin sets and tanks and all hazardous constituents.

- Use the same process the Hanford Site is using for waste immobilization.

- Don't let Yucca Mountain waste volume restrictions drive technology development; the Yucca Mountain repository may never open.

B.3.3 CANDIDATE ALTERNATIVES

DOE's first step in conducting the candidate alternative selection process was to review previous DOE and INTEC HLW studies as described earlier in this appendix. The study included five major INTEC waste treatment studies conducted between January 1994 and September 1997 and helped to ensure that DOE included all reasonable and viable alternatives. Potential alternatives were then identified through a systematic, iterative process that used several sources including: (1) previous INTEC HLW studies, (2) value engineering sessions, and (3) stakeholder comments received during the Idaho HLW & FD EIS scoping process.

B.3.3.1 Alternatives Considered for Initial Analysis

This systematic process resulted in an initial set of potential candidate alternatives for consideration in the Idaho HLW & FD EIS. The candidate alternatives include waste processing, interim storage, transportation, and final disposal options. It is important to note that each candidate alternative is composed of individual process stages (e.g., HLW treatment, interim storage, and/or disposal of low-activity grout) that are independent. Therefore, each candidate alternative is a combination of possible process stages that may be modified as the EIS preparation progresses. This modular approach will allow DOE greater programmatic flexibility in implementing the HLW alternatives and coordinating programs and technologies from other DOE sites. DOE identified the following waste processing alternatives and options for initial EIS screening, analysis, and evaluation.

1. No Action Alternative (as described in the Notice of Intent)

2. Separations Alternatives

    A. Full Separations
    B. 2006 Plan
    C. Transuranic Separations/Class A Grout
    D. Transuranic Separations/Class C Grout

3. Non-Separations Alternatives

    A. Vitrified Waste
    B. Hot Isostatic Pressed Waste
    C. Cement-Ceramic Waste
    D. Direct Cement Waste

Additional information concerning these candidate alternatives to be considered for initial analysis is provided in DOE (1999).

B.3.3.2 Alternatives Not Considered for Initial Analysis

Several candidate alternatives were eliminated from initial EIS analysis. These alternatives were not considered for one or more of the following reasons: (1) did not meet the purpose and need of the EIS, (2) required significantly more development work to achieve technical maturity, (3) are very similar to or are bounded by other selected alternatives, or (4) judged to be impractical or too costly for consideration.

Alternatives Rejected for Technological Reasons

- *In situ* vitrification
- Upgrading tanks for long-term storage
- Use of Hanford crystalline silicotitanate technology
- Storage of wastes in long-lasting concrete containers

- Homogenization and mixing of various wastes (i.e., slurry)
- Use of small solid units to fill tanks versus poured liquids

Alternatives Rejected That Do Not Support the EIS Purpose and Need

- Treatment of Argonne National Laboratory-West spent nuclear fuel at INTEC
- Burning of HLW in a reactor such as the Integral Fast Reactor
- Import other sites' HLW to INEEL for treatment and interim storage
- Use of old INTEC facilities as a second HLW repository

B.4 Evaluation of Candidate Alternatives

The primary purpose of this preliminary EIS alternative evaluation is to evaluate the candidate alternatives identified in Section B.3 and identify a reasonable set of alternatives for the Idaho HLW & FD EIS. The secondary purpose of this alternative evaluation is to provide a sound, traceable, and defensible process to support the final selection of potential Idaho HLW & FD EIS alternatives. These potential alternatives will provide for the treatment, storage, and disposition of HLW and SBW currently managed at the INTEC.

B.4.1 EVALUATION METHODOLOGY

The methodology for the identification of the candidate alternatives was based upon a comprehensive evaluation of all potential alternatives with respect to six essential Idaho HLW & FD EIS criteria (see next section). A DOE team of experienced personnel, who qualitatively assessed each alternative against the criteria, performed the evaluation. The DOE Evaluation Team was asked to recommend a reasonable set of candidate alternatives with high potential to meet the criteria and to identify unreasonable alternatives with low potential to meet the selection criteria.

Prior to the evaluation of the candidate alternatives, DOE reviewed a comprehensive list of documents and identified a set of considerations or sub-elements for the six evaluation criteria areas. The team focused on identifying important program considerations, stakeholder sensitivities, and related waste management data that would help evaluate potential alternatives with respect to each criterion.

The DOE Evaluation Team then systematically applied the criteria to all candidate alternatives to assess how well each alternative met the program goals and stakeholder concerns. The assessment of each alternative with respect to each criterion was done on a qualitative basis. Each alternative was given one of three ratings for each criterion as shown in the following table.

Table B-1. Alternative rating symbols.

Rating symbol	Alternative rating description
Plus (+)	Expected to satisfy the criteria with minor deficiencies or concerns
Zero (0)	Expected to satisfy the criteria with some deficiencies or concerns
Minus (–)	Expected to satisfy the criteria with major deficiencies or concerns

After reviewing the reference materials and conducting a structured, lengthy discussion period, the DOE Evaluation Team rated all candidate alternatives with respect to each of the six evaluation criteria. Then the team held a consensus meeting to determine an overall team rating for the alternatives with respect to each criterion. The team addressed each criterion in turn to ensure that all essential elements of each criterion were assessed and that the final qualitative ratings represented a team consensus.

The DOE Evaluation Team completed final discussions and analyses to determine which alternatives are considered reasonable and worthy of being retained as an EIS candidate alternative. The Team made a diligent effort to include a reasonable range of alternatives with potential to satisfy DOE program requirements and stakeholder and public concerns. The team agreed that inclusion of too many alternatives, rather than too few, will ensure that a reasonable range of viable alternatives is included in the EIS process to meet the National Environmental Policy Act requirements.

The DOE Evaluation Team was also asked to identify potential new alternatives that were not included in the initial set of candidate alternatives. The Evaluation Team accomplished this by reviewing the processes involved in selecting the initial set of candidate alternatives, then applying their knowledge of HLW management technologies and the requirements of the National Environmental Policy Act. This process resulted in the identification of the following additional alternatives for evaluation: (1) a No Action Orderly Shutdown Alternative, and (2) an Early Vitrification Option under the Non-Separations Alternative. The Team then evaluated these two additional alternatives against the evaluation criteria described below.

B.4.2 EVALUATION CRITERIA

A major step of the evaluation methodology was to develop the appropriate selection criteria. DOE developed the screening criteria to be used for selecting the set of alternatives. First, DOE determined that the appropriate criteria should have the following attributes:

- Logical, defensible, and clear to all parties
- Appropriate for waste processing alternative evaluation
- Limited to major program considerations and stakeholder concerns
- Easily evaluated by qualitative methods and analysis
- Inclusive of all major areas of concern and program viability

DOE proposed and analyzed a baseline set of eight criteria before selecting the final criteria. The eight baseline criteria (see Table B-2) were developed after reviewing the selection criteria used in previous HLW studies and two recent DOE Environmental Impact Statements: the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (SNF & INEL EIS) (DOE 1995) and the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997a). As a result of review and analysis of the candidate criteria in these documents, DOE selected the following six criteria deemed appropriate for this EIS: (1) Program Mission, (2) Technical Feasibility, (3) Cost Factors, (4) Environment, Safety, and Health, (5) Stakeholder and Tribal Issues, and (6) Program Flexibility.

Table B-2. Proposed versus selected criteria summary.

Proposed baseline criteria	Selected EIS criteria
1. Program Mission	1. Program Mission
2. Cost	2. Cost Factors
3. Technical Feasibility and Maturity	3. Technical Feasibility
4. Environment, Safety, and Health Impact	4. Environment, Safety, and Health
5. Stakeholder and Political Views	5. Stakeholder and Tribal Issues
6. Use of Existing Facilities	6. Program Flexibility
7. Transportation	
8. Compliance with Regulations and Agreements	

Table B-2 shows the eight baseline criteria in the left column and the six selected criteria in the right column. The selected criteria include all but the last three of the baseline criteria. "Use of Existing Facilities" and "Transportation" were not included because they were considered second order factors that would be reflected in "Cost Factors." Similarly, "Compliance with Regulations and Agreements," although very important to the overall mission in terms of ability to dispose of listed wastes, was not included because it is an essential element of the "Program Mission" and "Stakeholder and Tribal Issues" criteria. The "Program Flexibility" criterion was added because DOE considered funding flexibility a key program asset.

B.4.3 APPLICATION OF CRITERIA TO CANDIDATE ALTERNATIVES

B.4.3.1 Program Mission

The Program Mission criterion is essential to assessing capability of the alternatives to meet DOE complex-wide and INEEL HLW program objectives, major regulatory and National Environmental Policy Act milestones, and legal obligations. Table B-3 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-3. Program mission ratings.

Candidate alternative	Rating	Candidate alternative	Rating
1. No Action		3. Non-Separations	
1A Notice of Intent	–	3A Vitrified Waste	+
1B Orderly Shutdown	–	3B Hot Isostatic Pressed Waste	0
2. Separations		3C Cement-Ceramic	0
2A Full Separations	+	3D Direct Cement	0
2B 2006 Plan	+	3E Early Vitrification	+
2C Transuranic Separations/ Class A Grout	+		
2D Transuranic Separations/ Class C Grout	+		

For the Program Mission criterion, both options under the No Action Alternative were assessed minus (–) ratings. These alternatives do not meet the Settlement Agreement/Consent Order requirement to have all HLW road ready by 2035, and they do not address the long-term issue of removing all HLW from the State of Idaho, nor does the Orderly Shutdown Option meet the requirement to complete calcination of liquid SBW by 2012.

All four separations alternatives were assessed a plus (+) rating with minor deficiencies or concerns. Since the separations concept was driven by program mission requirements to reduce HLW disposal volume, the high ratings were expected. The separations options may lower the HLW volume for repository disposal to minimize transportation risk and cost, and they are consistent with DOE planning documents such as the Environmental Management Contractor Report (EMI 1997), *Accelerating Cleanup: Paths to Closure* (DOE 1998), and National Environmental Policy Act Records of Decision (RODs), with minor exceptions.

Under the Non-Separations Alternative, the Vitrified Waste and Early Vitrification Options were assessed a plus (+) rating because both would meet the essential requirements of the Settlement Agreement/Consent Order and produce a final waste form (borosilicate glass) that has a high probability of acceptance at a geologic repository. The other three options under the Non-Separations Alternative were assessed a zero (0) rating with some deficiencies or concerns. All three options would require a determination of equivalency by U.S. Environmental Protection Agency (EPA).

B.4.3.2 Cost Factors

Inclusion of the Cost Factors criterion was considered essential because this EIS proposes a DOE Federal project that would be supported by taxpayer funding. This cost criterion includes consideration of life-cycle costs, ten-year costs, peak funding requirements, and the results of an independent risk-based cost study. The detailed cost estimates of the risk-based study are contained in Section 5.0 of DOE (1999). Table B-4 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-4. Cost factor ratings.

Candidate alternative	Rating	Candidate alternative	Rating
1. No Action		3. Non-Separations	
1A Notice of Intent	0	3A Vitrified Waste	–
1B Orderly Shutdown	+	3B Hot Isostatic Pressed Waste	0
2. Separations		3C Cement-Ceramic	0
2A Full Separations	0	3D Direct Cement	0
2B 2006 Plan	–	3E Early Vitrification	–
2C Transuranic Separations/ Class A Grout	0		
2D Transuranic Separations/ Class C Grout	0		

All the candidate options, except Orderly Shutdown, 2006 Plan, Vitrified Waste, and Early Vitrification, were deemed equivalent with respect to cost and received the zero (0) rating with some deficiencies or concerns. No cost estimates were available for the Orderly Shutdown Option, but it was given a plus (+) rating because of the obvious minimal costs for an orderly shutdown of INTEC facilities. The 2006 Plan Option under the Separations Alternative was considered more expensive than the other separations options due to the calcination of both HLW and SBW and the subsequent calcine dissolving, separating, and processing the waste fractions into final waste forms.

With respect to the Non-Separations Alternatives, the Vitrified Waste Option was judged to have a higher life-cycle cost due to the high cost of a vitrification facility, the greater volume of material to be vitrified, and the greater amount of vitrified HLW to be transported to a geologic repository. No cost estimates were available for the Early Vitrification Option since it was a late entry to the candidate list. However, the Early Vitrification Option was assessed as more costly and assigned a minus (–) rating to reflect the potential cost of a vitrification facility and greater volumes of HLW compared to the Separations Alternative.

B.4.3.3 Technical Feasibility

Technical Feasibility or technical risk is a primary criterion to assess the capability of an alternative to meet the planned HLW program goals and milestones. Some alternatives may be more easily implemented due to use of proven technologies or the availability of well-developed processes. For alternatives that require new, unproven technologies, the Evaluation Team assessed the state of development (i.e., research and development, advanced development, or full-scale testing) and whether or not the proposed process requires a technical breakthrough or further testing and modification. Table B-5 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

The DOE Evaluation Team concluded that both options under the No Action Alternative should receive a plus (+) rating because they rely solely on facilities and processes that are currently operational and require no major high-risk modifications. Therefore, the technical risk associated with these alternatives should be very low.

The Team also noted that all four options under the Separations Alternative use the same basic and proven dissolution, separations, vitrification, and grouting technologies. All these separations treatment

Table B-5. Technical feasibility ratings.

Candidate alternative		Rating	Candidate alternative		Rating
1. No Action			3. Non-Separations		
1A	Notice of Intent	+	3A	Vitrified Waste	+
1B	Orderly Shutdown	+	3B	Hot Isostatic Pressed Waste	+
2. Separations			3C	Cement-Ceramic	–
2A	Full Separations	+	3D	Direct Cement	+
2B	2006 Plan	+	3E	Early Vitrification	0
2C	Transuranic Separations/ Class A Grout	+			
2D	Transuranic Separations/ Class C Grout	+			

technologies are well developed, proven technologies that have been successfully demonstrated throughout the DOE complex and industry. The current DOE HLW treatment at the Savannah River Site Defense Waste Processing Facility and at the West Valley Demonstration Project evidences the technical maturity of the vitrification process. Therefore, all four options of the Separations Alternative received a plus (+) rating.

Under the Non-Separations Alternative, the Vitrified Waste, Hot Isostatic Pressed Waste, and Direct Cement Waste Options all received a plus (+) rating due to incorporation of well developed, demonstrated technologies at INEEL. The Early Vitrification Option was assessed a zero (0) rating because of the unknowns associated with the vitrification of SBW.

The Cement-Ceramic Option received a minus (–) rating due to the high-risk treatment process, (i.e., calcination of SBW/calcine slurry in the New Waste Calcining Facility). The New Waste Calcining Facility, designed to process a liquid feed, would have to undergo major modifications to process the slurry mixture. No research and development work has been done to demonstrate the feasibility of calcining this slurry feed in the New Waste Calcining Facility.

B.4.3.4 Environment, Safety, and Health

The Environment, Safety, and Health criterion focuses on the risk of radioactive and hazardous materials emissions, potential migration into the Snake River Plain aquifer, waste volume produced, potential worker exposure during operations, and complex process hazards. Table B-6 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-6. Environment, safety, and health ratings.

Candidate alternative		Rating	Candidate alternative		Rating
1. No Action			3. Non-Separations		
1A	Notice of Intent	0	3A	Vitrified Waste	0
1B	Orderly Shutdown	–	3B	Hot Isostatic Pressed Waste	–
2. Separations			3C	Cement-Ceramic	–
2A	Full Separations	0	3D	Direct Cement	0
2B	2006 Plan	–	3E	Early Vitrification	0
2C	Transuranic Separations/ Class A Grout	0			
2D	Transuranic Separations/ Class C Grout	0			

Based on preliminary worker risk data (DOE 1997b), the Orderly Shutdown, 2006 Plan, Hot Isostatic Pressed Waste, and Cement-Ceramic Options were considered least acceptable due to increased worker risk as compared to the other alternatives and received a minus rating. The increased worker risk for the 2006 Plan, Hot Isostatic Pressed Waste, and Cement-Ceramic Alternatives was attributed to longer periods of hazardous activity and more complex and higher risk processes. In the case of the Orderly Shutdown Alternative, the liquid SBW in the Tank Farm and the HLW calcine in the bin sets, to be left indefinitely at the INTEC, increased worker and environmental risk. For these reasons these options were all assessed a minus (–) rating.

Based on the limited amount of definitive information (only worker risk data) available to the team, the remaining alternatives received a zero (0) rating because of minimal worker risk and insufficient information to rank the alternatives in the other sub-elements of Environment, Safety, and Health.

B.4.3.5 Stakeholder and Tribal Issues

Considerations for the Stakeholder and Tribal Issues criterion were obtained from stakeholder and public comments submitted during the EIS scoping period. The sub-elements of the Stakeholder and Tribal Issues criterion include final HLW form, disposal sites, aquifer impacts, waste acceptance criteria at the proposed geologic repository, definition of SBW, equity with respect to other DOE sites, HLW transportation, and tribal cultural and historic resources. Table B-7 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-7. Stakeholder and tribal issues ratings.

Candidate alternative		Rating	Candidate alternative		Rating
1. No Action			3. Non-Separations		
1A	Notice of Intent	–	3A	Vitrified Waste	+
1B	Orderly Shutdown	–	3B	Hot Isostatic Pressed Waste	0
2. Separations			3C	Cement-Ceramic	0
2A	Full Separations	0	3D	Direct Cement	0
2B	2006 Plan	0	3E	Early Vitrification	+
2C	Transuranic Separations/ Class A Grout	0			
2D	Transuranic Separations/ Class C Grout	+			

The DOE Evaluation Team assigned a minus (–) rating to both options under the No Action Alternative because neither alternative addresses the widespread opposition to long-term storage or disposal of HLW above the Snake River Plain aquifer. Also, the alternatives do not meet the Settlement Agreement/Consent Order requirement to have all INEEL HLW road ready by 2035.

Under the Separations Alternative, the Evaluation Team assigned the Full Separations, 2006 Plan, and Transuranic Separations/Class A Grout Options a zero (0) rating because of several concerns. These concerns include the long time estimated for the treatment processes, possible transportation for offsite treatment, health and safety of workers, and potential lack of a disposal facility that would accept INEEL HLW.

The Transuranic Separations/Class C Grout Option was given a plus (+) rating due to the possibility of eliminating the need for disposal of the HLW at the geologic repository. This is due to the planned classification of the high-activity fraction as transuranic waste, which would be eligible for disposal at the Waste Isolation Pilot Plant. Also, this option addresses the stakeholder concerns of meeting the Settlement Agreement/Consent Order milestones. Both of the Transuranic Separations options would require an "incidental waste" determination which may be difficult to obtain, thus decreasing the likelihood of success for these options.

Under the Non-Separations Alternative, the Evaluation Team gave the Vitrified Waste and Early Vitrification Options a plus (+) rating. These options respond to stakeholder concerns of reducing worker risk (no separations activities) and expediting vitrification, which produces the acceptable waste form for disposal in a geologic repository.

The team gave zero (0) ratings to the Hot Isostatic Pressed Waste, Cement-Ceramic, and Direct Cement Waste Options to reflect the concerns for technical complexity of the treatment processes and their capability to meet the waste acceptance criteria at the disposal site. Moreover, these options would require additional research and development before the EPA could determine waste form equivalency to borosilicate glass.

B.4.3.6 Program Flexibility

Program Flexibility is an attribute of program management that allows critical major funding decisions to be made in a logical, phased approach. Thus, critical decisions to implement costly programs could be done in a serial, time-phased manner to assess results of the initial phases or to allow time for technical maturity. The key to program flexibility is to minimize the number of irrevocable funding commitments at the early stages of a program. Table B-8 presents the results of the Evaluation Team's ratings of the candidate alternatives against this criterion.

Table B-8. Program flexibility ratings.

Candidate alternative			Rating	Candidate alternative			Rating
1.	No Action			3.	Non-Separations		
	1A	Notice of Intent	+		3A	Vitrified Waste	–
	1B	Orderly Shutdown	–		3B	Hot Isostatic Pressed Waste	–
2.	Separations				3C	Cement-Ceramic	–
	2A	Full Separations	0		3D	Direct Cement	–
	2B	2006 Plan	0		3E	Early Vitrification	–
	2C	Transuranic Separations/ Class A Grout	0				
	2D	Transuranic Separations/ Class C Grout	0				

The Notice of Intent Option of the No Action Alternative was assessed a plus (+) rating with minor deficiencies because it is a short term, business-as-usual alternative with no significant changes in operations and requires no new facilities. Therefore, this option has high program flexibility with respect to cost and schedule because no processes or facilities that require early funding commitments would be needed.

All four options under the Separations Alternative were assigned a zero (0) rating with some deficiencies or concerns. These separations options require early funding commitments for the new separations facility, which reduces program flexibility in the near-term. However, the options under the Separations

Alternative have high program flexibility in the long-term because the HLW is separated into high-activity and low-activity waste fractions that allow several immobilization and disposal options to be considered at later stages of the program.

The five options under the Non-Separations Alternative were considered to be relatively inflexible compared to the No Action and Separations Alternatives. These five options were assessed a minus (-) rating with major deficiencies or concerns. These concerns relate to the early program commitments to SBW calcination, SBW and calcine retrieval, HLW immobilization, HLW interim storage, and the potential need to construct a new vitrification facility at INEEL.

B.5 Evaluation Summary and Results

Based on the preliminary criteria ratings, the DOE Evaluation Team completed the final discussions and analyses to determine which options are considered reasonable and worthy of being retained on the HLW Candidate Alternative List. Options with all pluses (+) would be top candidates for inclusion. Options with pluses and zeroes (0) were also considered definite EIS candidates. However, options with more zeroes than pluses triggered additional analysis to ensure the zero ratings were not indications of inherent weaknesses. Options rated with one or more minuses were re-evaluated to determine if the minus ratings were significant enough to eliminate them. If the minus ratings indicated large areas of uncertainty, the evaluators reduced the uncertainty by obtaining and reviewing additional data.

The team made a diligent effort to include a reasonable range of options with potential to satisfy DOE program requirements and concerns of stakeholders and the public. At this stage of the EIS, it is considered better to include too many options rather than too few to ensure identification of an adequate range of options. In any case, subsequent EIS analyses will be sufficiently rigorous to identify unreasonable options and eliminate them from further consideration.

Table B-9 shows the total criteria ratings achieved by all the candidate alternatives during the alternative evaluation discussed in the previous section. As shown in the table, the Transuranic Separations/Class C Grout Option under the Separations Alternative was assessed the highest total rating of +3 and the Cement-Ceramic Option under the Non-Separations Alternative was assessed the lowest total rating of –3. Since the total rating spread (lowest to highest total rating) was only 6 points and the lowest alternative

Table B-9. Total rating of candidate alternatives.

Alternative	Program mission	Cost	Technical feasibility	ES&H	Stakeholder and tribal	Program flexibility	Total rating
1. No Action							
1A Notice of Intent	–	0	+	0(–)[a]	–	+	0(–1)[a]
1B Orderly Shutdown	–	+	+	–	–	–	–2
2. Separations							
2A Full Separations	+	0	+	0	0	0	+2
2B 2006 Plan	+	–	+	–	0	0	0
2C Transuranic Separations/Class A Grout	+	0	+	0	0	0	+2
2D Transuranic Separations/Class C Grout.	+	0	+	0	+	0	+3
3. Non-Separations							
3A Vitrified Waste	+	–	+	0	+	–	+1
3B Hot Isostatic Pressed Waste	0	0	+	–(0)[a]	0	–	–1(0)[a]
3C Cement-Ceramic	0	0	–	–(0)[a]	0	–	–3(–2)[a]
3D Direct Cement	0	0	+	0	0	–	0
3E Early Vitrification	+	–	0	0	+	–	0

a. The ratings in parentheses represent potential changes to final ratings and are based on discussions after the initial evaluation and additional information received by the Team. These potential changes have no effect on the Evaluation Team's final recommendations.

was only a –3 rating, the Evaluation Team recommended that none of the initial candidate alternatives be rejected at this time. Moreover, the Team analysis confirmed that none of the minus ratings indicated areas of serious or inherent weakness.

In Table B-9, the No Action Notice of Intent, Hot Isostatic Pressed Waste, and Cement-Ceramic Options have Environment, Safety, and Health criterion ratings that are followed by revised ratings in parentheses that resulted from further reviews. The rationale for these revised ratings is presented below; however, the ratings do not alter the final recommendations.

The No Action Notice of Intent Option was originally rated zero (0) because of minimal worker impact from continuing calcination. However, this option would require storing the calcine in the bin sets and leaving the tank heels in place indefinitely, which stakeholders would consider an unfavorable long-term situation. Thus, the team revised the Environment, Safety, and Health rating to a potential minus (–) rating.

The Hot Isostatic Pressed Waste and Cement-Ceramic Options were originally given minus (–) ratings for environment, safety, and health due to worker risk. The ratings were changed to a zero (0) rating after further review indicated that worker risk would be less than originally assessed because: (1) the risk-based alternative study (DOE 1997b) showed that the normalized worker risk for these options is less than the No Action Notice of Intent Option, which was accorded a zero rating, and (2) the alternatives pose less risk to the public than the No Action Notice of Intent Option because the waste would be processed and shipped to an offsite facility.

In summary, the Evaluation Team recommended that all the candidate options shown in Table B-9 be retained. However, some of the options have greater technical risk and require significant technology development to remain viable candidates.

B.6 Refinement of DEIS Alternatives

Following the evaluation of candidate alternatives described in the previous section, several events occurred that affected the selection of alternatives for the Idaho HLW & FD EIS. These events include consideration of shipping stabilized HLW (or calcine or separated high-activity waste) to the Hanford Site for processing, use of the proposed INEEL Advanced Mixed Waste Treatment Project for processing certain HLW-related waste streams, and use of a cesium ion exchange process for treatment of liquid SBW and newly generated liquid waste. These events led DOE to further refine the Idaho HLW & FD EIS alternative selection process. The details of this refinement process are contained in DOE (1999) and are summarized below.

B.6.1 DEIS ALTERNATIVES REFINEMENT (PHASE I)

DOE convened an Alternative Refinement Meeting on May 21, 1998 to evaluate the list of EIS alternatives considering the events described above. The following comparison factors (elimination criteria) were used by DOE personnel during the meeting:

- *Two or more alternatives share common process characteristics, but one presents*:
  - A bounding case for environment, safety, and health impacts
  - Substantially reduced cost

- Substantially reduced waste handling risks
- Similar impacts, but with an increased chance for public and/or regulator acceptance

- *An implementation alternative presents a process that would likely result in*:

  - Lack of expected regulator/DOE approval
  - Lack of ability to construct or operate facilities in the required time period
  - Significantly higher volume of waste for disposal
  - Significantly higher worker risk
  - Unreasonably higher cost to treat a small volume of waste
  - Unreasonably higher worker risk to process a small volume of waste
  - Creation of an intermediate waste form that cannot be transformed into an acceptable final waste form for disposal

The results of this meeting are documented in DOE (1999). DOE meeting attendees identified the following alternatives in Table B-10 as "alternatives considered but not analyzed" and "alternatives identified for further DEIS analysis with use of the comparison factors," as discussed previously. The rationale for these conclusions is described below.

Table B-10. Summary of the Phase I Alternative Refinement Meeting.

Alternatives considered but not analyzed	Alternatives identified for further analysis
• **No Action Alternative** – No Action Orderly Shutdown Option • **Separations Alternative** – 2006 Plan Option – Transuranic Separations/Class A Grout Option – Offsite Disposal of Class C Grout Option under the Transuranic Separations Option • **Non-Separations Alternative** – Vitrified Waste Option • **Minimum INEEL Processing Alternative** – Advanced Mixed Waste Treatment Facility Option	• **No Action Notice of Intent (per Notice of Intent)** • **Separation Alternative** – Full Separations Option – Transuranic Separations/Class C Grout Option • **Non-Separations Alternative** – Hot Isostatic Pressed Waste Option – Direct Cement Waste Option – Early Vitrification Option • **Minimum INEEL Processing Alternative** – Full Transport Option – Full Transport with Alternate SBW Treatment Option

No Action Alternative - Orderly Shutdown Option – The group concluded that the No Action Orderly Shutdown Option was not an environmentally responsible alternative and would not be an effective basis of comparison of the action alternatives. This option would not meet any of the Settlement Agreement/Consent Order and other requirements and does not tier off the SNF & INEL EIS decision to continue to operate the New Waste Calcining Facility (DOE 1999). Under this option, the decision to shut down the New Waste Calcining Facility would be made in Fiscal Year 2000, and none of the INTEC HLW management facilities, including the Tank Farm, would be closed. The process vessels would be emptied of waste solutions, and some decontamination rinses would be performed. The Orderly Shutdown Option would stop the operation of the Process Equipment Waste Evaporator system and the Liquid Effluent Treatment and Disposal Facility, and would not empty or close the Tank Farm. The shutdown facilities would be left in a safe condition but would not be monitored. Thus, the group concluded that this option would be eliminated from further consideration.

Separations Alternative - 2006 Plan Option – The 2006 Plan Option is identical to the Full Separations Option except that the SBW would not be processed (separated) directly but would be calcined in the New Waste Calcining Facility by 2012 before dissolution and separation.

Thus, the 2006 Plan Option would require three major processing facilities (i.e., New Waste Calcining Facility with high-temperature and Maximum Achievable Control Technology upgrades, Calcine Dissolution and Separations Facility, and a HLW Vitrification Facility). The proposed 2006 Plan Option waste form would require redissolution of calcine with potential higher life cycle costs and worker risks than other separation options. For these reasons and for the additional processing and storage facilities required, it is apparent that this option offers no advantages over the Full Separations Option. It was also predicted to cost considerably more than the Full Separations Option. The group determined that it be eliminated from the alternative list.

Non-Separations Alternative - Vitrified Waste Option – The calcining of SBW and newly generated liquid waste is the only action that differentiates the Vitrified Waste Option from the Early Vitrification Option. This option not only creates an additional waste form (SBW calcine) to be vitrified with the HLW calcine but also would not maintain the beneficial segregation of the SBW calcine from the HLW calcine. Because of this potential co-mingling, this option could result in a larger quantity of HLW being shipped to a geologic repository for disposal with the attendant higher disposal costs and would require greater facility costs for vitrification and storage. Therefore, it is apparent that there are no advantages for this option over the Early Vitrification Option that otherwise contains the same treatment concepts. For

these reasons, the group concluded that the Vitrified Waste Option should be eliminated from further EIS consideration.

Offsite Low-Activity Waste Disposal – The group determined that offsite disposal of Class A grout should be retained in this EIS. Initially, Hanford was selected to be a representative offsite location for Class A grout disposal. However, disposal at Hanford has been eliminated from consideration because previous evaluations of low-activity grout disposal at Hanford have indicated that the long-term (beyond 1,000 years) impacts of low-activity grout disposal could exceed regulatory standards for groundwater protection. Also, Hanford's current HLW management strategy calls for vitrifying the low-activity waste prior to onsite disposal; thus, it is unlikely that Hanford would accept grouted INEEL low-activity waste for disposal. The group then recommended that the Envirocare facility in Utah be considered as a representative offsite disposal facility because it is a commercial facility that is limited only by its waste acceptance criteria.

No Action Alternative - per Notice of Intent – No Action Notice of Intent Option was re-aligned by the group to include the following requirements to meet the Notice of Noncompliance Consent Order:

- Run the New Waste Calcining Facility until June 2000.
- Place the New Waste Calcining Facility in standby and perform the high temperature and Maximum Achievable Control Technology upgrades.
- Run the High-Level Liquid Waste Evaporator until 2003 while the New Waste Calcining Facility is being upgraded.
- Complete the New Waste Calcining Facility permitting and upgrades by 2010.
- Run the New Waste Calcining Facility at an accelerated schedule to calcine the SBW by 2014.

Separations Alternative - Full Separations with Hanford Vitrification – This option is identical to the Full Separations Option except for the suboption to perform high-activity waste vitrification at the Hanford Site instead of at INEEL. In this option, the high-activity waste fraction would be solidified, packaged, and shipped to the Hanford Site for vitrification. The resulting HLW canisters would be returned to INEEL for interim storage awaiting shipment to a geologic repository. The group concluded

that the Idaho HLW & FD EIS will include "Hanford Vitrification" as an independent transportation analysis that will be covered in this EIS. The at-Hanford impacts would be discussed in a separate section of the EIS. This would allow the public to isolate the "at-INEEL" and "at-Hanford" impacts.

Separations Alternative - Transuranic Separations/Class A Grout Option – This option is similar to the Full Separations Option, except the separation process under this option would result in three waste products:

- Transuranic waste
- Fission products (primarily strontium/cesium)
- Class A grout

In the Transuranic Separations/Class A Grout Option, the liquid SBW would be sent directly to the Separations Facility for processing into high-activity and low-activity waste streams. After the SBW is processed, the HLW calcine would be retrieved from the bin sets, dissolved, and processed in the Separations Facility. Ion exchange columns would be used to remove the cesium from the waste stream. The resulting effluent would undergo the transuranic extraction process to remove the transuranic elements for eventual shipment to the Waste Isolation Pilot Plant. Then strontium would be removed from the transuranic extraction effluent stream via the strontium extraction process. The cesium and strontium would be combined to produce a high-activity waste stream that would be vitrified into borosilicate glass. This glass would be stored in an interim storage facility before shipment to a geologic repository. The Transuranic Separations waste would be dried and denitrated to produce a granular solid waste, and the low-activity waste would be denitrated and grouted to form Class A grout.

Comparison of the Transuranic Separations/Class A Grout Option to the Transuranic Separations Option described earlier in this appendix provides justification for eliminating it from consideration. As was the case for the Full Separations Option, the Transuranic Separations/Class C Grout Option process would create only two waste streams: (1) solidified transuranic waste for disposal at the Waste Isolation Pilot Plant and (2) a low-activity waste stream to form Class C grout for onsite disposal. The Transuranic Separations/Class A Grout Option would involve more separations steps than the Transuranic Separations/Class C Grout Option and would require a larger Waste Separations Facility. Also, the Transuranic Separations/Class A Option would require a separate High-Activity Waste Treatment (Vitrification) Facility and a High-Level Waste Interim Storage Facility that have an estimated cost substantially greater than the Transuranic Separations (Class C Grout) Option.

The estimated total discounted cost for the Transuranic Separations/Class A Grout Option is $3.29 billion, which would be 80 percent greater than the estimated total discounted cost of $1.82 billion for the Transuranic Separations (Class C Grout) Option. Thus, the Transuranic Separations/Class C Grout Option is similar, has less complex separations processing, and is more cost-effective than the Transuranic Separations/Class A Option. Moreover, the impacts of this option are expected to be bounded by the remaining two options under the Separations Alternative. For these reasons, the Transuranic Separations/Class A Option was eliminated from further consideration in this EIS.

Non-Separations Alternative - Cement-Ceramic Waste Option – The Cement-Ceramic Waste Option under the Non-Separations Alternative is similar to the Direct Cement Waste Option except the liquid SBW would not be calcined directly but would be mixed with the existing calcine to form a slurry. In this option, all calcine would be retrieved and combined with the liquid SBW. The combined slurry would be recalcined in the New Waste Calcining Facility with the resulting calcine mixed into a concrete-like material. The concrete waste product would then be poured into drums, autoclaved (curing in a pressurized oven), and stored in an interim storage facility before shipment to a geologic repository. An estimated 16,000 concrete canisters would be produced. This option would require a calcine retrieval system, a major modification to the New Waste Calcining Facility to allow slurry calcination and the upgrade for compliance with the Maximum Achievable Control Technology rule, and a Grout Facility with autoclave. The final product would require an equivalency determination by EPA.

The rationale for initially considering the Cement-Ceramic Waste Option in the EIS was the potential for significant cost savings in using a greater confinement facility (such as at the Nevada Test Site) as the final repository for the resulting product. A basis for this assumption was that the cementitious waste form and the alluvial soil at the greater confinement facility were chemically compatible, and the cement waste form would be the least likely to migrate in the surrounding soil. However, the greater confinement facility for HLW disposal has not been constructed, nor has DOE approved the project for construction at this date. Moreover, DOE experiences at the Waste Isolation Pilot Plant and Yucca Mountain suggest that the development of a repository is a lengthy, costly, and high-risk undertaking. In addition, if INEEL were the only site disposing HLW at a greater confinement facility, INEEL would bear all costs associated with the development of the repository (e.g., site characterization and performance assessments associated with U.S. Nuclear Regulatory Commission licensing and EPA certification of compliance). Therefore, it is unlikely that significant cost savings at a greater confinement facility could be realized over a geologic repository where INEEL would pay only a prorated share of the development and operational costs based on its share of the waste disposed of.

Even if the Cement-Ceramic Waste Option had a high potential to reduce life cycle costs, the fact that DOE has included the Direct Cement Waste Option, which has lower technical risk than the Cement-Ceramic Waste Option, negates the need to include the Cement-Ceramic Waste Option in the EIS analysis. The Cement-Ceramic Waste Option is based on calcination of SBW/calcine slurry in the New Waste Calcining Facility, which is currently configured to process a liquid feed. To reconfigure the New Waste Calcining Facility to process an SBW/calcine slurry would be costly. Even if the New Waste Calcining Facility were modified to accept the slurry feed, no prior research and development work has been conducted to verify the feasibility of calcining the slurry. Thus, a significant technical risk would remain for this process. For these reasons the Cement-Ceramic Waste Option was eliminated from further consideration in this EIS.

Minimum INEEL Processing Alternative – The group concluded that an additional alternative, entitled the "Minimum INEEL Processing Alternative," should be analyzed in the Idaho HLW & FD EIS. This alternative would have two options: (1) the Full Transport Option and (2) the Full Transport with Alternate SBW Treatment Option. Under either option in this alternative, DOE would perform only the minimum activities necessary to prepare the calcine for shipment to the Hanford Site for treatment. In the Full Transport Option, DOE would also solidify and package the SBW for transport to Hanford. In the Full Transport with Alternate SBW Processing Option, DOE would not ship the SBW to Hanford but would instead process the SBW through an ion-exchange column to remove the cesium and grout to create a contact-handled transuranic waste that DOE would ship to the Waste Isolation Pilot Plant.

B.6.2 EIS ADVISORY GROUP (EAG) REVIEW

Subsequent to the Alternatives Refinement Meeting, DOE convened the Idaho HLW & FD EIS Advisory Group Meeting on June 30 and July 1, 1998. The purpose of the EIS Advisory Group is to provide a forum to assess the resolution of issues related to preparation and review of this EIS. The EIS Advisory Group concluded that the alternatives resulting from the Phase I Alternatives Refinement Meeting are acceptable except that the No Action Alternative should be revised so it does not include expected Maximum Achievable Control Technology upgrades to the New Waste Calcining Facility or construction of new storage tanks. DOE subsequently decided that the alternative previously entitled the No Action Alternative would be retained but would be retitled the "Continued Current Operations" Alternative.

B.6.3 ALTERNATIVE REFINEMENT (PHASE II)

A second alternative refinement meeting was held on September 16, 1998. The intent of this second meeting was to discuss the potential Hanford alternatives for treatment of INEEL HLW and SBW. The DOE Evaluation Team concentrated on evaluating the physical characteristics of the Hanford alternatives and the timing for potential shipments of waste to Hanford for treatment. Timing of shipments is critical since it affects the treatment processes at INTEC, which would supply the waste for Hanford treatment.

The DOE Evaluation Team evaluated several options for treatment of INTEC wastes at Hanford, including (1) direct vitrification of calcine, (2) direct vitrification of separated high-activity waste, (3) calcine separations, and (4) shipping SBW/newly generated liquid waste to the Hanford Site for treatment. The DOE Evaluation Team concluded that only Option 3, "calcine separations," should be evaluated in the EIS. DOE's rationale for eliminating the other options is explained in DOE (1999) and Section 3.3 of this EIS.

Therefore, the Minimum INEEL Processing Alternative would entail shipping calcine from INEEL to Hanford, separation of this calcine at Hanford into high-activity and low-activity streams, and vitrification of both waste streams at Hanford. The vitrified high-activity waste would be shipped back to INEEL for interim storage pending shipment to a geologic repository, while the vitrified low-activity waste would be shipped back to INEEL for disposal. The existing liquid SBW and newly generated liquid wastes would be retrieved and transported to an ion exchange facility, where it would be filtered and processed through an ion exchange column. The filtered solids would be dried and disposed of at the Waste Isolation Pilot Plant as remote-handled transuranic waste. The loaded ion exchange resin would be temporarily stored at INEEL, dried and containerized, and transported to Hanford for vitrification. After ion exchange, the liquid waste would be grouted to produce a contact-handled transuranic waste for disposal at the Waste Isolation Pilot Plant.

B.6.4 STATE OF IDAHO REVIEW

As described in Section 1.3, the State of Idaho is serving as a "Cooperating Agency" in the preparation of this EIS. In fulfilling this responsibility, the State reviewed the list of waste processing alternatives. The State's review concluded that the 2006 Plan Option comes the closest to fulfilling the Settlement Agreement/Consent Order and should be analyzed in the EIS. DOE incorporated the State's recommendation and evaluated this option in the EIS but retitled it the "Planning Basis Option."

B.7 Final List of Alternatives

Therefore, as a result of all the activities discussed in this Appendix, the Idaho HLW & FD EIS analyzes the following waste processing alternatives and options:

1. No Action Alternative
2. Continued Current Operations Alternative
3. Separations Alternative

    A. Full Separations Option
    B. Planning Basis Option
    C. Transuranic Separations Option

4. Non-Separations Alternative

    A. Hot Isostatic Pressed Waste Option
    B. Direct Cement Waste Option
    C. Early Vitrification Option

5. Minimum INEEL Processing Alternative

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